FIREBERD 8000

Take testing to the next level

Key Features

- Native datacom interfaces for EIA-530, EIA-530A, RS-449 (422 and 423), RS-232, X.21, V.35, and V.36 serial interfaces
- Government standards support for MIL-188C and MIL-188-114
- Interface module slot for conditioned diphase and expandability to new technologies
- Synchronous/asynchronous DTE/DCE modes of operation
- ANSI and ITU BER patterns with data rate support up to 18 Mb/s
- "Virtual breakout box" functionality allows flow control troubleshooting with user controllable signaling leads (CTS, RTS, DTR, RLSD, and DSR)
- New FB-8000-ADVR option offers clock and data phase graphing and broken lead detection capabilities

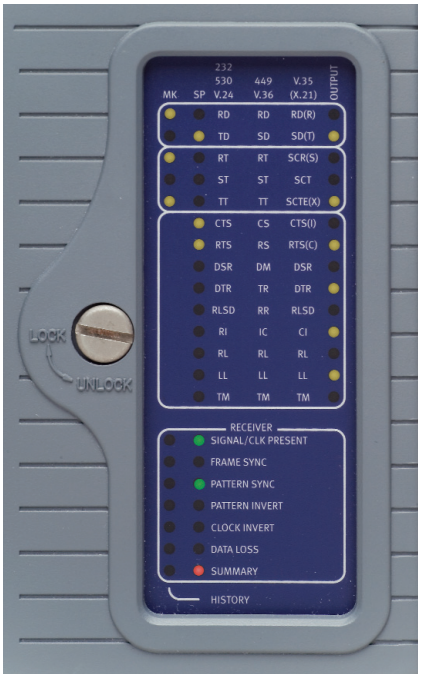
Since the introduction of the FIREBERD 1500 in 1983, the FIREBERD legacy continues with more than 30,000 FIREBERD mainframes in the field today and over 20 years of industry experience in physical layer testing.

Version 3 of the FIREBERD 8000 (FB-8000), which is designed to meet the testing needs of technicians who are installing and maintaining data communications circuits and network elements, now offers enhanced troubleshooting capabilities as well as an Advanced Datacom Results (ADVR) option. This software version provides technicians with the ability to further troubleshoot their datacom applications past simple "go"/"no go" testing and into root cause analysis of circuit problems. In addition, the ADVR option provides technicians with clock and data phase graphing and broken lead detection capabilities.

The FB-8000 provides test functionality for a wide variety of technologies, including RS-232/V.24, EIA-530, EIA-530A, V.35/306, RS-449/V.36, X.21, MIL-188C, MIL-188-114, and conditioned diphase. Supported applications of the FB-8000 include verifying end-to-end circuit continuity and throughput, stressing and verifying clock recovery circuits, and verifying quality of service (QoS).

Building on the success of the JDSU TestPad platform, the addition of the FB-8000 allows technicians to easily migrate from datacom to OC-192/48 and Ethernet technologies, support battery operation, and enjoy the size of a handheld tester - all in one instrument.

Take testing to the next level with a single platform for new and legacy requirements



Front panel LEDs monitor signaling and data leads of the circuit under test.

Traffic Generation

The FIREBERD 8000 includes all of the common BER patterns, including the patterns found in the JDSU FIREBERD 6000A and T-BERD product lines. This enables the FB-8000 to run an end-to-end test in conjunction with a FB-6000A, FB-6000, FB-60000M, MC-6000, or FB-4000.

Internal, External, and Recovered Clock Capabilities

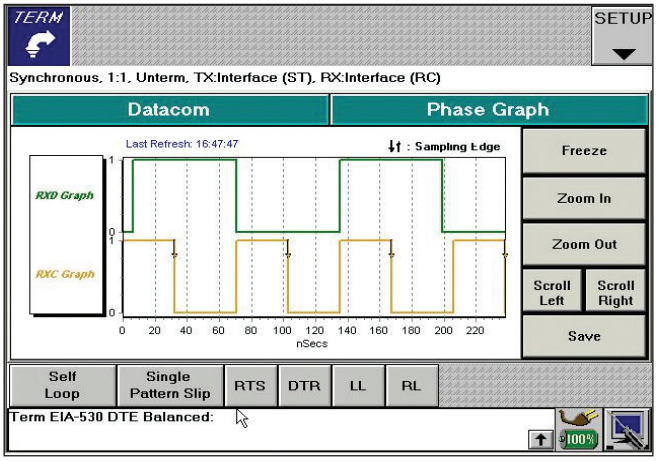
The FB-8000 provides the same timing options as the legacy FB-6000: internal, external, interface, and recovered. In balanced V.11 modes, the FB-8000 supports synchronous clocking up to 18 Mb/s. The recovered clocking option also allows the FB-8000 to extract clocking from the receiver data signals up to 10 Mb/s.

Clock and Data Phase Graphing

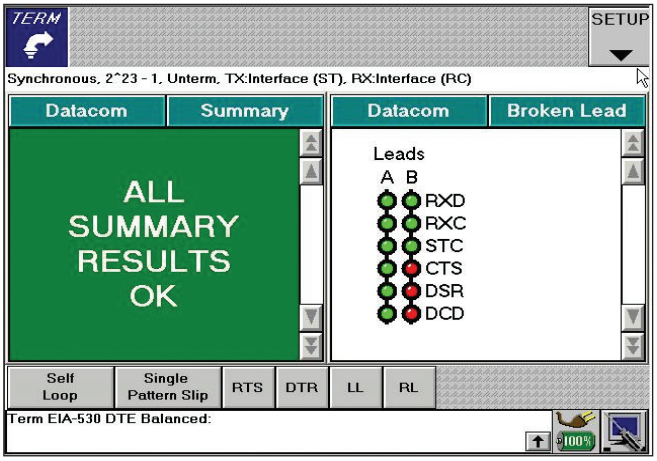
At high bit rates, processing and propagation delays as well as lengthy cables may result in clock-to-data skew as data signals pass through the various equipment in the network. These delays can lead to clock inversions, difficulty in synchronization, and eventually errors in the data transfer. The clock and data phase graphing feature of the FB-8000 provides a visual indication of the clock versus data phase relationship, providing quick insight into problems without requiring an oscilloscope.

Broken Lead Detection

Some digital circuits will continue to operate correctly when one lead of a balanced (differential) circuit is broken. In these cases, the signal ground lead becomes the return current path, causing reduced fidelity. The broken lead detection feature of the FB-8000 allows technicians to detect broken incoming leads for DTE and DCE modes, eliminating the need for a breakout box to verify lead connectivity on the datacom circuit.



Identifying problems using the clock and data phase graphing feature



Green leads indicate connectivity; red leads indicate a broken lead

"Virtual Breakout Box" Functionality

Easy-to-interpret LEDs on the FB-8000 provide technicians with information regarding the state of the signaling and data leads of the circuit under test, much like a breakout box. In addition, user-controllable signaling leads (CTS, RTS, RLSD, DTR, DSR, RI, TM, RL, and LL) are available. The combination of LEDs and signal lead manipulation allows for complete flow control troubleshooting.

Test Interface Modularity

Like its predecessors, the FB-8000 includes a field-upgradable module slot to support conditioned diphase and future technologies. Therefore, technicians can purchase datacom and conditioned diphase test functionality and enjoy the flexibility of field upgrading the FB-8000 with new JDSU option slot test modules easily and efficiently.

Remote Operation and Results Storage

Removable storage media can be connected through a PC card interface on the FB-8000, facilitating the storage of test results for external reporting and analysis. Results can also be configured to print at the end of a test, periodically during the test, or at any occurrence of an error. Customized printouts are also available showing only the specified results, allowing for quick detection of hard-to-find bit error rate (BER) problems and easy interpretation of test results.

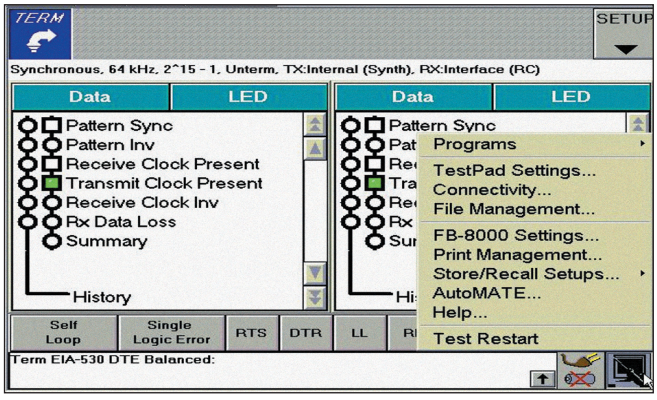
Battery Operation

In keeping with the portable requirements of today's technicians, the FB-8000 can be battery operated to maximize its portability, particularly in environments where AC power is unavailable or unreliable.

Durability

The FB-8000 was built with ruggedness in mind. The platform meets all of the key MIL-PRF 28800 F standards for operation and storage in harsh environments and is backed by JDSU's standard three-year warranty.

Module slot facilitates field upgrades for future technologies.



Easy-to-Use Graphical User Interface (GUI).

Applications

Verifying End-to-End Connectivity

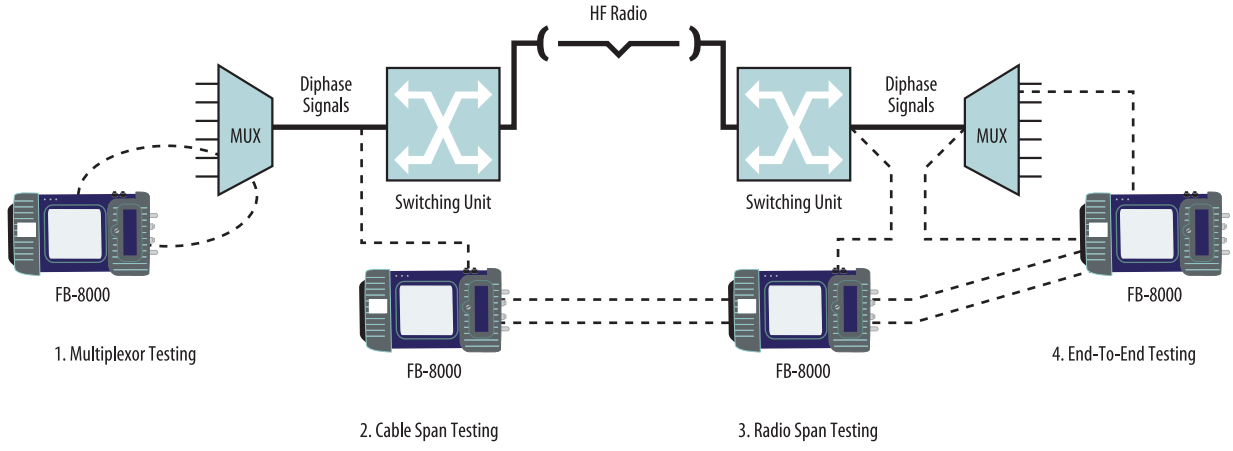
Using two FB-8000s, technicians can quickly isolate any problem to a specific direction by analyzing the performance of an entire digital link in both directions. With a variety of supported interfaces, the FB-8000 allows for the performance of multiplexer or loopback testing on sections of the link to quickly verify operation or to isolate a problem. The FB-8000 can be connected at access points in the network to verify channel routing, cable integrity, and communication across radio or satellite links. Full duplex end-to-end testing also enables excellent analysis of all circuits and equipment within the network. Testing can also be performed with loopback testing using built-in remote and local loopback modes.

Timing Analysis

In Synchronous mode of operation, if a receiving device's data is not synchronized to the clock signal, it may misinterpret bits, causing a bit error. The FB-8000 provides all of the standard clocking options, allowing technicians to rapidly diagnose network timing problems. Technicians can operate the FB-8000 on circuits that support data rates up to 18 Mb/s, allowing for network element verification of high-speed datacom signals and components.

The recovered clock capability of the FB-8000 allows technicians to differentiate timing problems from transmission problems by using different clock modes. In addition, a new standard feature enables technicians to generate clock slips at the transmitter by inserting an extra bit into the normal bit pattern, thereby stressing the clock recovery circuits.

A key source of problems includes propagation delay of signals, commonly leading to inverted clock situations. The new clock and data phase graphing feature of the FB-8000 provides a graphical display of clock and data phase relationships, including clock sampling edges. This feature allows technicians to quickly identify clock inversion problems.



Verifying End-to-End Connectivity

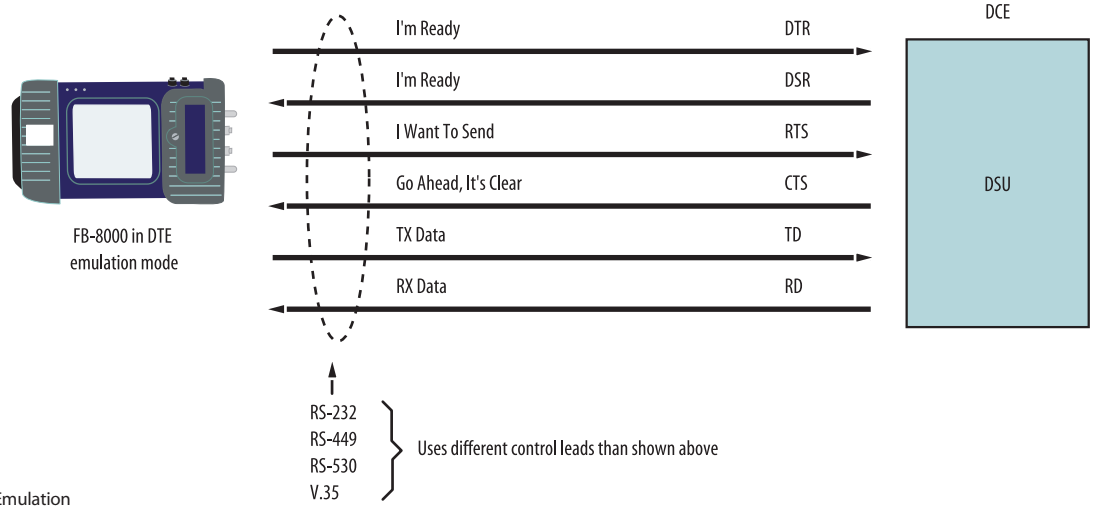
DTE and DCE Emulation

At the physical interface, the interaction between the DTE and DCE is comparable to a telephone conversation. The connection between the DTE and DCE uses transmit and receive lines and separate control signal lines. Using the FB-8000, technicians can replace a network element (either DTE or DCE) to verify that proper interaction is taking place between the elements. Through the use of "virtual breakout box" functionality and user-controllable signaling leads, technicians can verify the proper operation of the DTE or DCE under test.

Quality of Service Testing

Circuits must be qualified before service hand-off to the end user. The FB-8000's results analysis, including round trip delay, G.821, and pattern slips, allows technicians to quickly verify that circuits are performing according to specified metrics before they are brought into service.

The FB-8000 now features a graphical histogram capability, displaying all counter results in graphical format. The FB-8000 can monitor bit errors, block errors, pattern losses, clock losses, receiver data losses, and transceiver clock losses.



DTE and DCE Emulation

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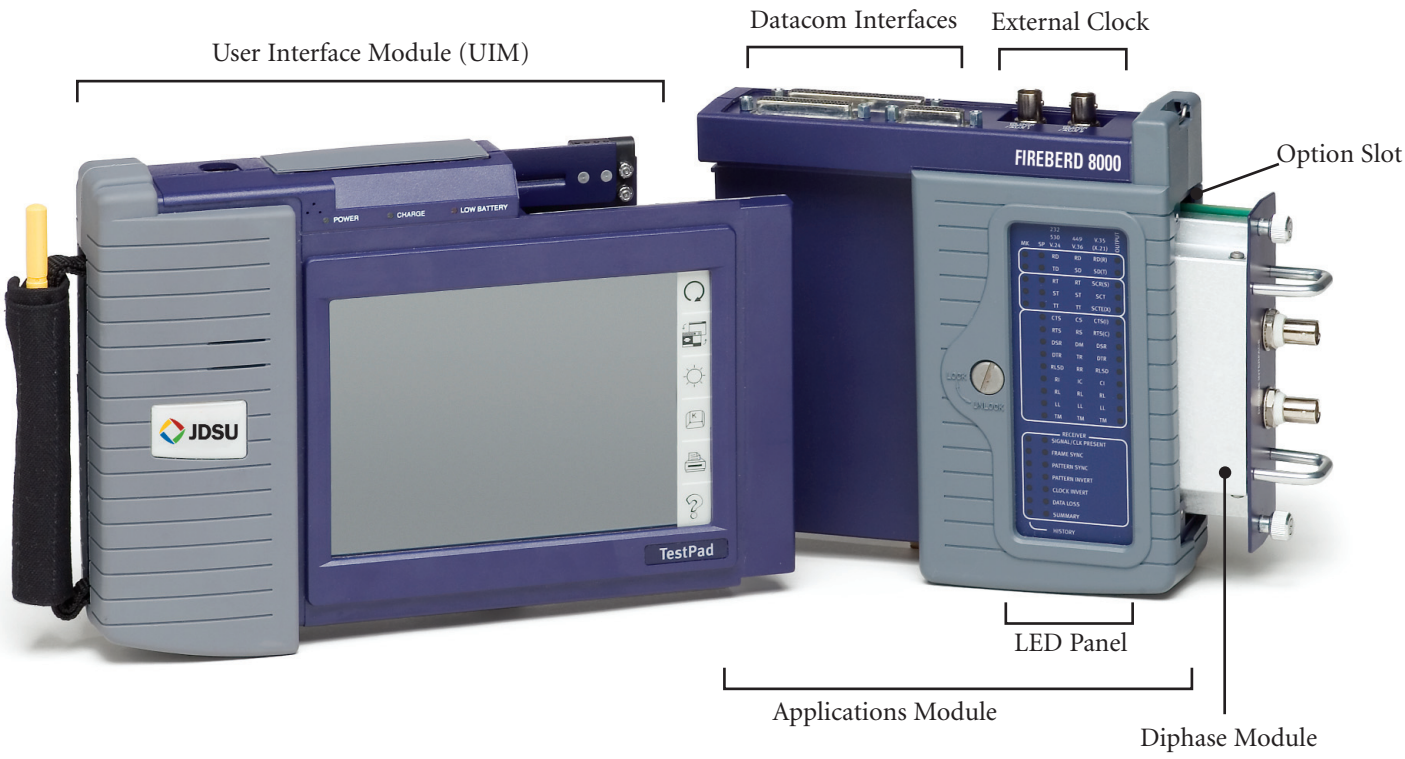
Physical Characteristics



Specifications

User Interface (Part # 2000-V6) Mechanical specifications

Dimensions	6.7 x 11.5 x 2.2 in (with handstrap)
Weight	3.75 lb
Speaker and Microphone	Built in
PCMCIA slot	2 Type II CardBus Slots (also supports 1 Type III Slot)
AC adapter	100-220 at 60 Hz or 200-240 at 50 Hz VAC to 19V DC, 2.95 A
Battery	10.8 VDC Nickel-Metal-Hydride (NiMH)
Calibration Interval	None
LCD	Graphic color display (Touchscreen), 6.2 inch diagonal viewable area
Resolution	640x480 pixels
LEDs	Power, Charging, Low Battery
Operating	32ºF (0ºC) to 113ºF (45ºC)*
Storage	-4ºF (-20ºC) to 140ºF (60ºC)

* Note: The upper operating temperature limit is 122ºF (50ºC) while not charging the battery.

FB8000 Applications Module Mechanical specifications

Dimensions	7.5 x 13.5 x 2.2 in
Weight	1.70 lb
Menu language	English
Calibration Interval	every 3 years

Environmental specifications

Temperature

Operational temperature range	32ºF (0ºC) to 122ºF (50ºC)
Storage temperature range	-40ºF (-40ºC to 167ºF (75ºC)

Safety

- UL
- CSA
- TUV

FCC class A

Front Panel LEDs

Datacom

- MARK, SPACE, OUTPUT
- RS-232/V.24/EIA-530/EIA-530A: RD, TD, RT, ST, TT, CTS, RTS, DSR, DTR, RLSD, RI, RL, LL, TM
- RS-449/V.36: RD, SD, RT, ST, TT, CS, RS, DM, TR, RR, IC, RL, LL, TM
- V.35: RD, SD, SCR, SCT, SCTE, CTS, RTS, DSR, DTR, RLSD, CI, RL, LL, TM, RI
- X.21: R, T, S, X, I, C

Receiver

- CURRENT, HISTORY, SIGNAL PRESENT, CLOCK PRESENT, FRAME SYNC, PATTERN SYNC, PATTERN INVERT, CLOCK INVERT, DATA LOSS, SUMMARY

Interfaces

Datacom

X.21

- 15-pin D-type connector
- Emulate DTE or DCE with X or S timing
- Receiver input termination: unterminated or 78/100/124 Ω
- Data rates:
  - 5 b/s to 18 Mb/s synchronous with X, cable length dependent with S
  - 5 b/s to 128 kb/s asynchronous
  - 5 b/s to 10 Mb/s recovered
- Supported signaling leads: C and I

RS-232/V.24

- 25-pin D-type connector
- Emulate DTE or DCE with TT or ST timing
- Data rates:
  - 5 b/s to 128 kb/s synchronous
  - 5 b/s to 128 kb/s asynchronous
  - 5 b/s to 128 kb/s recovered
- Supported signaling leads: CTS, RTS, DSR, DTR, RLSD, RI

EIA-530/530A

- 25-pin D-type connector
- Emulate DTE or DCE with TT or ST timing
- Signal formats and input terminations:
  - Balanced: un-terminated or 78/100/124 Ω terminated
  - Unbalanced
- Data rates:
  - Balanced
    - 5 b/s to 18 Mb/s synchronous
    - 5 b/s to 128 kb/s asynchronous
    - 5 b/s to 10 Mb/s recovered
  - Unbalanced
    - 5 b/s to 128 kb/s synchronous
    - 5 b/s to 128 kb/s asynchronous
    - 5 b/s to 128 kb/s recovered
- Supported signaling leads: RTS, CTS, DSR, DTR, RLSD, LL, RL, TM

MIL-STD-188c

- 25-pin D-type connector
- Emulate DTE or DCE with TT or ST timing
- Signal formats and input terminations:
  - Unbalanced
- Data rates:
  - 5 bps to 64 kbps synchronous
  - 5 bps to 64 kbps asynchronous
  - 5 bps to 64 kbps recovered
- Supported signaling leads: RTS, CTS, DSR, DTR, RLSD, LL, RL, TM, RI

RS-449/V.36 and MIL-188-114

- 37-pin and 25-pin D-type connectors
- Emulate DTE or DCE with TT or ST timing
- Signal formats and input terminations:
- RS-422 and MIL-188-114 Balanced: unterminated or 78/100/124 terminated
- RS-423 and MIL-188-114 Unbalanced
- Data rates:
  - RS-422/Balanced
    - 5 b/s to 18 Mb/s synchronous
    - 5 b/s to 128 kb/s asynchronous
    - 5 b/s to 10 Mb/s recovered
  - RS-423/Unbalanced
    - 5 b/s to 128 kb/s synchronous
    - 5 b/s to 128 kb/s asynchronous
    - 5 b/s to 128 kb/s recovered
- Supported signaling leads: RS, CS, DM, TR, RR, LL, RL, TM, IC

V.35

- 34-pin Winchester using an adapter cable to 25-pin D-type connector
- Emulate DTE or DTC with TT (306) or ST timing
- Receiver input termination: 124 Ω
- Data rates:
  - 5 b/s to 15 Mb/s synchronous
    Note: Due to propagation delay (cable length dependencies), the user may have to invert their clock.
  - 5 b/s to 128 kb/s asynchronous
  - 5 b/s to 520 kb/s recovered
- Supported signaling leads: RTS, CTS, DSR, DTR, RLSD, RL, LL, TM, CI

Conditioned Diphase

- 2 BNC connectors: 1 TX and 1 RX (via plug-in Interface module)
- Receiver:
  - Selectable-input termination: 58 , 135 , or bridge (>2000)
  - Single-ended operation: 58 Ω
  - Differential operation: 135 or bridge
  - Automatic compensation up to 30 dB of cable loss
  - Valid signal indication: signal valid if > ± 90 mV and < ± 150 ppm of the selected frequency
- Transmitter:
  - Single-ended operation: 58 Ω
  - Differential operation: 135 Ω
    - Transmit timing selectable from internal synthesizer or recovered from receiver interface
- Data rates
  1.2, 2.4, 4.8, 9.6, 16, 32, 64, 72, 128, 144, 256, 288, 512, 576, 1024, 1152, 1536, 2048, 2304, 4096, 4608 KHz
- Clock and data encoding:
  - Diphase (Manchester)
  - Conditioned Diphase

Key Functionality

BER test patterns

- Mark (All Ones), Space (All Zeros), 1:1, 63, 511, 2047, 2047R (Reverse), 2047RI (Reversed and Inverted), 2^15-1*, 2^20-1*, 2^23-1*, QRSS, Programmable (1,2,3), QBF1 (FOX), QBF (2,3), Long User (1,2,3), Delay, All Zeros, 1:3, 1:4, 1:7, 3:1, 7:1

*Note: Both ANSI and ITU variations of these patterns are supported.

Transmit clock sources

- Internal from synthesizer
- Recovered from test interface (with the Recovered Clock option)
- External BNC

Internal clock synthesizer

50 Hz to 18 MHz, ± 1 Hz resolution, 1 ppm accuracy, 1 ppm per year aging

5 Hz to 50 Hz, ± 1 Hz resolution, 20 ppm accuracy, 1 ppm per year aging

Error insertion

- Bit error(s): single and rate (1E-3 through 1E-6)

Pattern slip insertion

-Single bit insertion

Signaling lead control

- Emulate DTE: RTS, DTR, (LL), (RL)
- Emulate DCE: RLSD (RR), DSR (DM), CTS, RI

Clock and data phase graph

- Timescale resolution = 1 ns
- Maximum sampling frequency (fixed) = 155.52 MHz, 1 ppm accuracy, 1 ppm per year aging
- Sample uncertainty = Sample period is approx. 6.43 ns
- Channel-to-channel skew = 3 ns (typical)*

*Note: Skew between input and output channels is not defined.

Self loop

- All test interfaces will loop transmit to receive for the purpose of validating the instrument and the selected test interface.

Asynchronous operation

- Parity selection: odd, even, and none
- Data bits: 5, 6, 7, or 8 bits
- Stop bits: 1, 1.5, or 2 bits
- In-band flow control
- Out-of-band flow control

Remote Operation

- The unit will support remote GUI operation through an Internet browser or VNC viewer.

Key Results

Logic Category

- Delay, Pattern Losses, Pattern Slips, Bit Errors, Bit Error Rate, Interval BER, Total Blocks, Block Errors, Block Error Rate, Int Block Error Rate, Character Errors (Async only)

Signal category

- Transmitter Clock, Frequency, Receiver Clock Frequency, Clock in Frequency, Clock out frequency

Data category

- Receiver Clock Loss, Data Loss, Pattern Sync Loss, Transmitter Clock Losses

G.821

- Err Secs, % Err Sec, Error Free Secs, % Error Free Secs, Sev Err Sec, % Sev Err Sec, Deg Min, % Deg Min, Avail Secs, % Avail Secs, Unavail Secs, Cons Sev Err Sec, Errored Non-SES, BER Non-SES

Time category

- Date, Time, Elapsed Seconds, Elapsed Time, Error Analysis Seconds,Test Seconds (sync only) Error-free Error Analysis Seconds, Errored Error Analysis Seconds, Pattern Loss Seconds

Ordering Information

Applications Module – FIREBERD 8000

- FB-8000
  FIREBERD Applications Module
  Includes RS-232/V.24, RS-449/V.36, V.35/306, EIA-530, EIA-530A, X.21, MIL-188C, MIL-188-114
- FB-8000-Diphase
  Includes conditioned diphase interface module
- FB-8000-CLK
  Includes Clock Recovery option
- FB-8000-ADVR
  Advanced Datacom Results
  Includes Clock/Data Phase Graphing and Broken Lead Detection options

User Interface

2000-V6
JDSU FST-2000 TestPad User Interface Module (UIM)

Additional application modules available

FST-2510A TestPad	High Speed Optical Analyzer
FST-2310 TestPad	SONET Services Module
FST-2207 TestPad	T1/T3 Wireless Module
FST-2209 TestPad	T1/T3 Services Module
BAT-2700 TestPad	Base Station and Air Interface Test Module
FST-2802 TestPad	Gigabit Ethernet Module

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